

APPLICATION
FOR
UNITED STATES LETTERS PATENT

TITLE: PROGRAMMABLE ECHO CANCELLATION FILTER
APPLICANT: ANTONIO DIGIANDOMENICO, PETER PESSL AND
CHRISTIAN FLEISCHHACKER

CERTIFICATE OF MAILING BY EXPRESS MAIL

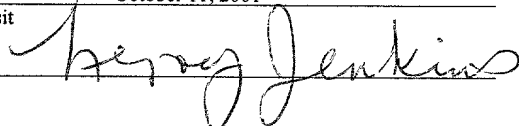
Express Mail Label No. EL298424510US

I hereby certify under 37 CFR §1.10 that this correspondence is being deposited with the United States Postal Service as Express Mail Post Office to Addressee with sufficient postage on the date indicated below and is addressed to the Commissioner for Patents, Washington, D.C. 20231.

October 11, 2001

Date of Deposit

Signature



Leroy Jenkins

Typed or Printed Name of Person Signing Certificate

099799-10401
T010199460

Description

Programmable echo cancellation filter

- 5 The invention relates to a programmable echo cancellation filter for echo signal cancellation of echo signals of a transceiver.

10 In signal transmission systems, when a transmission signal is emitted from a transceiver to a signal line, echo signals superposed on the reception signal always occur. In this case, on account of the attenuation of the signal line, the amplitude of the echo signal is significantly higher than the amplitude of the reception signal. A transceiver contains an echo
15 cancellation filter in order to attenuate or extinguish the echo signal superposed on the reception signal.

Figure 1 shows a transceiver according to the prior art, which contains an echo cancellation filter EC. The data to be transmitted by the transceiver are emitted from a data source DQ to a digital/analog converter DAC, where they are converted into an analog transmission signal and filtered in an analog filter
20 connected downstream. The filtered transmission data pass via a signal line driver LT to a hybrid circuit, from where they are emitted via the signal line to a terminal device, for example to a subscriber modem.

30 An echo signal whose signal amplitude is significantly higher than the signal amplitude of the signal received by the terminal device EG is superposed on the reception signal S_1 of the transceiver. In a signal matching circuit, the reception signal S_1 with the
35 superposed echo signal is prefiltered and the signal amplitudes are matched to the transceiver. The echo signal S_2 is fed to the signal matching circuit B, from where it passes to the echo cancellation filter EC. The

echo cancellation filter EC simulates the frequency response of the transmission signal path. The echo signal filtered by the echo cancellation filter EC is subtracted from the superposed reception signal in a subtraction circuit SUB, with the result that, in the ideal case, the automatic amplitude control circuit AGC receives the reception signal from which the echo signal has been eliminated.

10 The strength of the echo signal depends on the line impedance of the signal line, which fluctuates greatly in a manner dependent on the line length and on ambient influences. Therefore, each time a connection is set up between the transceiver and the terminal device EG
15 connected via the signal line, the echo cancellation filter EC is dynamically matched anew to the present line impedance in a so-called training phase. For this purpose, the echo cancellation circuit EC is correspondingly set by a control circuit. This is done
20 by means of controllable switches contained in the echo cancellation circuit EC.

The echo cancellation filter EC incorporated in the transceiver according to the prior art, as is
25 illustrated in figure 1, contains active circuit components with operational amplifiers which are supplied with voltage with a supply voltage U_v of the transceiver. In order to minimize power losses, the supply voltage U_v of the transceiver is increasingly
30 chosen to be lower. Increasingly, technology dictates the use of transceivers which operate with a low supply voltage of less than 3.3 V.

The controllable switches contained in the echo
35 cancellation filter EC are conventionally realized by controllable MOS transistors whose gate terminals are driven by the control circuit. On account of the signal voltage swing occurring at the MOS field-effect